

Construction Paths and Practical Reflections on Digital Textbooks under the Background of Educational Digital Transformation: A Case Study of the Digital Textbook Construction Project at Central China Normal University

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Abstract: Digital textbooks are an important component of the digital transformation of education, driving the high-quality development of higher education. This study takes the digital textbook construction project of Central China Normal University (CCNU) as the research object, clarifies the theoretical connotations and core characteristics of digital textbooks, and explores the construction paths of digital textbooks. Based on real teaching cases of CCNU, this paper reflects on the practical problems faced by digital textbooks in the construction and teaching processes, and proposes strategies for building an intelligent, open, and sustainable digital textbook ecosystem, aiming to provide a theoretical and practical reference for the construction and sustainable development of digital textbooks in higher education institutions in China.

Keywords: digital textbooks; educational digital transformation; construction paths; practical reflections

1. Introduction

The world is entering an era of digital and intelligent technologies, which are reshaping the spatial-temporal structures, existential modes and educational landscapes of humanity in an all-round way^[1]. *The 2024–2035 Master Plan on Building China into a Leading Country in Education* clearly proposes to accelerate the digital transformation of textbooks, improve the classification and management systems of textbooks, and build a world-class textbook system covering all levels and types of education^[2]. *Opinions on Accelerating the Digital Transformation of Education* issued by the Ministry of Education and eight other central authorities have further made systematic arrangements, clarified the development of standards for the construction and management of digital textbooks, and developed high-quality demonstration digital textbooks for multiple disciplines^[3]. *The White Paper on China's Smart Education* emphasized the reconstruction of the learning element system, integrating high-quality resources such as MOOCs, digital textbooks, and virtual simulation experiments to provide learners with precise and personalized learning services^[4]. These policy documents provide clear directions for promoting the construction of digital textbooks.

Traditional textbooks can hardly meet learners' demands for personalized and interactive learning. Endowed with dynamic and interactive characteristics, digital textbooks provide an effective solution to this problem. However, digital textbooks still face the practical challenge of moving from mere availability to practical utility and ultimately to educational effectiveness. As a national normal university directly under the Ministry of Education with rich experience in teacher education and educational informatization, CCNU has carried out systematic exploration into the development of digital textbooks in recent years. This paper systematically summarizes our construction paths and practical reflections, providing experience for university-level digital textbook construction nationwide.

2. Theoretical Connotation and Characteristics of Digital Textbooks

Scholarly understandings of digital textbooks have continuously evolved. Early definitions regarded

digital textbooks merely as digitized versions of printed materials, such as PDF documents, whose values lay mainly in convenient storage and distribution. With the development of network and multimedia technologies, digital textbooks evolved into richmedia learning resources that integrated audio, video and animations to enhance presentation effects, yet still imitated the structure of traditional textbooks.

Driven by progress in learning sciences and artificial intelligence, digital textbooks are now understood as comprehensive, intelligent instructional solutions and interactive learning environments. They are generated, updated and operated in digital contexts, aiming to develop students' core competencies and key skills, and integrate systematic disciplinary knowledge, multimedia resources, structured learning activities, embedded formative assessment tools and supporting services. This conceptual shift fundamentally redefines a digital textbook: it is no longer a passive knowledge container but a learning scaffold or an intelligent companion that supports inquiry, collaboration and personalized development. The essence of digital textbooks lies in educational innovation rather than technological forms. Their construction is a systematic interdisciplinary project involving pedagogy, psychology, computer science and educational design, rather than the simple digitization of printed textbook content.

3. Practical Exploration of Digital Textbook Construction at CCNU

We do not treat digital textbook development as an isolated technical project, but integrate it into the overall top-level design of educational reform. CCNU clarifies guiding principles, core objectives and institutional norms, while granting autonomy to individual development teams. This approach has fostered a standardized, collaborative, and high-quality construction framework, which can be summarized as: guided by advanced educational concepts, underpinned by collaborative innovation, guaranteed by standardized procedures, and oriented toward instructional effectiveness.

In terms of conceptual guidance, all digital textbook development teams are required to uphold the integration of educational values and technological empowerment. They must reject excessive technical spectacle and prioritize moral education and talent cultivation as fundamental goals. The development team of Artificial Intelligence Guidance adheres to this orientation, focusing on disciplinary core literacy, integrating cutting-edge cases, scientific ethics and foundational knowledge, and achieving synergy between ideological and political education and competency development. In response to the course's interdisciplinary nature, rapid knowledge updates and practical demands, the team adopts demand-oriented design to reduce learning barriers and strengthen the connection between theory and practice through multimodal and interactive functions.

We have established standardized procedures and full lifecycle management for digital textbook development. The team of *Physical Chemistry* established a cross-professional group including disciplinary experts, frontline instructors, and educational technology specialists. Through demand analysis, the team identified weaknesses in traditional teaching concerning abstract concepts, experimental visualization and real-time feedback, and prioritized interactivity, virtual experiments and personalized support. The team completed instructional design, content development, multimedia production and development of interactive tools, with a focus on virtual experiment systems to resolve long-standing teaching difficulties. In the stage of technical integration and platform implementation, the team independently completed the integration of textbook content and resources as well as the adaptation and debugging of multi-terminal access, ensuring the smooth display and stable operation of chemical formulas and experimental animations across different devices. Relying on the chemistry virtual teaching and research office, the team established a regular feedback and optimization mechanism, collected learning data and practical suggestions from teachers and students, and continuously improved the content and functional design of digital textbooks, forming a virtuous cycle of "practice, feedback, and optimization".

Our systematic construction approach has achieved remarkable results in various disciplines, and the digital textbooks developed by each team have basically realized the construction goals of innovating teaching modes, improving teachers' professional abilities and sharing high-quality educational resources. The development team of the Introduction to Linguistics digital textbook strictly follows the university's overall construction direction, and the compiled digital textbook fully embodies two important achievements in the construction of digital textbooks: the innovative application mode of textbooks and the construction of a teachers' professional development system. This digital textbook is not a simple static accumulation of disciplinary knowledge, but a comprehensive empowerment of the

teaching reform of linguistics courses in the form of a digital curriculum system. For teachers, the abundant high-quality teaching resources preset in the textbook greatly alleviate the burden of independently developing online courses and collecting various linguistic corpora, enabling them to focus more on the in-depth design of classroom teaching and targeted guidance for students, and effectively promoting the transformation of teachers' teaching modes and teaching concepts. For students, the powerful interactive functions, real-time feedback mechanisms and rich disciplinary cases of the textbook provide robust support and effective guidance for their autonomous learning and inquiry-based learning, and effectively address the prominent teaching challenges in linguistics courses. At the same time, the development team carries out training and exchange activities on the application experience of digital textbooks through the linguistics virtual teaching and research office, and provides clear application templates and professional teaching methods for linguistics teachers in CCNU and other universities, which effectively improves teachers' digital literacy and the practical application efficiency of digital textbooks, and addresses the prevalent issue of inadequate teacher preparation for the application of digital textbooks in higher education institutions.

4. Effectiveness, Challenges and Dialectical Reflections

The construction and application of digital textbooks have brought positive and far-reaching impacts on the teaching and learning activities of CCNU, while also exposing the inherent tensions and complex challenges faced by the education system in responding to the digital transformation of education.

4.1 Effectiveness of Teaching Practice

In the course of *History of Modern Chinese Literature*, students can immediately express their feelings and questions through the real-time comment function when reading the classic content of digital textbooks. These contents are projected onto the main screen after teachers' screening and become the starting points of classroom discussion. This participation method greatly enhances students' willingness to express themselves, especially among introverted students, so that the classroom is transformed from a teacher's monologue into a collaborative dialogue space. The functions of in-class testing, voting, and group task push allow teachers to quickly obtain feedback on the learning progress of the whole class and adjust the teaching rhythm in time to achieve precision teaching.

In the *Digital Animation Pre-Creativity and Design* course, students watch microlesson videos and complete basic concept self-assessments through digital textbooks before class; in class, they mainly carry out project-based group collaborative design and programming, with teachers providing on-site guidance to solve personalized learning problems for students; after class, they use the extended reading materials and online evaluation system in the digital textbook to consolidate learning achievements and improve professional abilities. Digital textbooks enable learning activities to transcend temporal and spatial constraints, achieve the organic integration of online autonomous learning and in-person teaching, and promote the fundamental transformation of traditional teaching modes. Although the construction and application of digital textbooks in CCNU are still in the exploratory stage, the personalized learning needs of students have been initially met.

The students' learning data recorded by the digital textbook system, such as the learning duration of each knowledge point, the video viewing completion rates, the in-class exercise accuracy rates and the distribution of error types, affords teachers an unprecedented in-depth understanding of students' learning conditions. Based on this objective learning data, the system can automatically issue early warnings to students with learning difficulties and deliver targeted remedial learning resources for timely academic intervention.

4.2 Practical Challenges and Inherent Contradictions in the Application of Digital Textbooks

Excessive use of gorgeous media effects and frequent interactive operations in digital textbooks may lead the focus of teaching to deviate from in-depth engagement with disciplinary knowledge to superficial sensory stimulation and mindless pursuit of interface operation experience^[5]. Over-reliance on human-computer interaction in the teaching process may invisibly weaken the informal face-to-face emotional communication and pedagogical inspiration between teachers and students, leading to a risk of dehumanization in teacher-student pedagogical relationships. Technology should always be a tool to

promote the all-round development of human beings, and the perfunctory application of technology must be firmly avoided, which is a fundamental value issue that must be responded to in the construction and application of digital textbooks.

In addition, the development of high-quality digital textbooks is a resource-intensive project involving interactive design, media production, program development, platform operation and maintenance, copyright procurement and other aspects, and its overall development costs are significantly higher than those of traditional paper textbooks. At present, there is a stark contradiction between the existing pricing mechanisms and one-time payment models for digital textbooks and the long-term investment required for their continuous update and maintenance. For publishers and textbook developers, there is great uncertainty about whether high investment can bring reasonable commercial returns, which seriously restricts the enthusiasm of developers to invest in the development of digital textbooks and carry out continuous optimization and upgrading of products, and may even push the construction of digital textbooks into a vicious cycle of high investment, low returns, and unsustainable development.

Teachers are the key stakeholders for the effective application of digital textbooks. A considerable number of teachers, especially senior teachers, have not yet mastered the skills to proficiently apply information and communication technologies, and most of them are accustomed to the traditional teaching modes and have a certain degree of psychological resistance to new digital teaching technologies. Even some teachers who have mastered basic operation skills can only carry out simple application of digital textbooks, and cannot deeply integrate the various functional advantages of digital textbooks into the overall design of the curriculum. A lack of teacher proficiency in digital application has become one of the most significant bottlenecks hindering the realization of the educational potential of digital textbooks. Therefore, it is urgent to establish a systematic and regular training system for improving teachers' digital literacy in higher education institutions.

Finally, the existing educational teaching evaluation system still over-relies on traditional summative evaluation methods such as final examinations, which is difficult to effectively assess students' higher-order thinking skills, collaborative learning competencies, and information literacy—all of which digital textbooks aim to foster. If the teaching evaluation method cannot keep pace with digital textbook construction and teaching reform, there will be a serious disconnect between pedagogical innovation and the conservatism of educational evaluation, which will greatly weaken the motivation of teachers and students to apply digital textbooks for in-depth learning. Establishing a comprehensive educational evaluation system compatible with digital teaching and integrating formative and summative assessment is the key to promoting the in-depth application of digital textbooks in university teaching.

5. Future Prospects and Strategic Suggestions

5.1 Technological Integration Prospect: From "Intelligentization" to "Metaverse-Oriented"

Generative Artificial Intelligence (AIGC) will bring revolutionary changes to the development and application of digital textbooks. In the future, digital textbooks are expected to evolve into intelligent generative learning companions that can dynamically generate explanatory texts, design personalized disciplinary examples and even compile story-based learning modules or micro-games according to students' real-time learning status and interactive dialogue content, providing students with a truly personalized learning experience of "one student, one version"^[6]. At the same time, they can also act as virtual tutors, providing open-domain intelligent Q&A and guided inquiry learning for students. In addition, Virtual Reality (VR), Augmented Reality (AR) and the concept of the Metaverse will greatly expand the application boundaries of digital textbooks. Students can walk into historical scenes, the interiors of molecules, or the vast cosmic expanse through VR devices to engage in immersive inquiry-based learning. AR technology can superimpose virtual teaching models and experimental scenes into the real physical world, enabling an immersive, interactive experience of virtual-real integration, which will completely change the existing presentation forms and users' cognitive perception of disciplinary knowledge.

5.2 Ecosystem Construction Strategies: Breaking Development Bottlenecks through Multi-subject Collaboration

National educational administrative departments need to further improve the top-level design of

digital textbook construction, introduce more detailed policies on quality certification, selection, access, data security, and privacy protection for digital textbooks, and accelerate the establishment and improvement of copyright trading and protection mechanisms adapted to the digital environment, so as to balance the legitimate rights and interests of digital textbook creators, publishers, and users, and effectively stimulate the innovative vitality of all stakeholders in digital textbook development.

The construction of digital textbooks needs to establish a robust multisubject coordination mechanism. It is suggested that government departments or educational industry associations take the lead in establishing a co-construction and sharing framework guided by the principle of “government leadership, enterprise participation, university application, and user feedback”, and promote the establishment of regional or disciplinary digital textbook R&D alliances, and achieve the co-construction and sharing of high-quality digital textbook resources and the rational sharing of development costs across universities. For the high-quality digital educational resources that have been built, flexible business models such as subscription services and modular pricing can be actively explored to ensure the sustainable circulation and efficient utilization of the resources of digital textbooks.

Professional development systems must be strengthened. Digital literacy should be incorporated into the national, provincial, and institutional-level training programs, with hierarchical curricula, instructional consulting, and sustained technical support. Schools should introduce incentive policies to recognize teachers’ efforts in innovating and applying digital textbooks.

Teaching evaluation should leverage the digital textbook’s strength in process data collection. Evaluation should shift from outcome-dominated to process-dominated^[7], using learning analytics, growth portfolios and project-based assessment to make hidden outcomes such as higher-order thinking visible and measurable, guiding teaching back to its educational mission.

6. Conclusion

Digital textbook construction is a core component of educational digital transformation. It represents far more than an upgrade to teaching tools; it fundamentally reshapes the future of education. Our practices show that successful digital textbook development requires adherence to the “student-centered, education-oriented” principle, following a pathway of “demand-driven, technology-enabled and collaboratively innovative”, with full-life-cycle quality assurance.

Digital textbooks have strong potential to enhance interaction, personalize learning and innovate instructional models. Yet they also face challenges including technological alienation, cost pressures, faculty adaptation and institutional evaluation lag. Future development should embrace AI, VR and emerging technologies with an open, dialectical and prudent attitude, and build a sound ecosystem featuring strong policy support, complete standards, multi-stakeholder collaboration, professional faculty development and adaptive evaluation. In this way, digital textbooks will evolve from technological products into powerful drivers of high-quality education and educational modernization, laying a solid foundation for cultivating high-quality talents for the great rejuvenation of the Chinese nation.

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